

Outbreak of Infectious Hepatitis, Apparently Milk-borne

W. J. MURPHY, M.D., AND L. M. PETRIE, M.D., F.A.P.H.A.

Georgia Department of Public Health, Atlanta, Georgia

AND

SAMUEL D. WORK, JR., M.D.

Forsyth, Ga.

OBSERVATIONS with respect to the spread of infectious hepatitis^{1, 2, 3} have generally indicated person to person transmission and have led many to believe that the disease spreads by droplet infection. On the other hand, from the results obtained by Cameron,⁴ MacCallum and Bradley,⁵ Findlay and Wilcox,⁶ Havens, Paul and van Rooyen,⁷ and others,^{8, 9, 10} in the experimental transmission of infectious hepatitis, it appears that the disease can be transmitted artificially to man by a number of routes. Furthermore, it appears that the icterogenic agent is present in the feces of the patient and that the disease can be produced in man by feeding such material in capsules. These findings suggest that under natural conditions food and drink may serve as vehicles for transmitting the infective agent and, in so far as water-borne transmission is concerned, they are supported by the observations of Neeffe and Stokes,¹⁰ and others.¹¹

The purpose of this report is to present epidemiological evidence that the icterogenic agent of infectious hepatitis may be transmitted by milk. The observations reported here are based on a study of a small outbreak of 10 cases which occurred in Forsyth, Ga., during the period of May 21 to June 28, 1945. The study was made at the request of

the attending physician (S.D.W.) who had observed that all of the patients drank milk supplied by a single dairy.

The diagnosis of infectious hepatitis was based largely on the clinical picture which was quite similar to that usually described. The onset was gradual with fever, malaise, headache, and anorexia, followed shortly by epigastric distress, nausea, and usually vomiting. In several patients abdominal pain was quite marked while tenderness on the right side was generally observed. In most cases the acute symptoms subsided prior to the onset of jaundice which appeared after 3 to 10 days. With few exceptions, the jaundice lasted less than 2 weeks and was accompanied by characteristic changes in the stool and urine. None of the patients gave a history of previous injections of homologous blood products. Blood from 3 of the patients taken 3 to 4 weeks after the onset gave negative agglutinations with antigens of *Leptospira icterohaemorrhagiae*. The tests were made in the laboratories of the Georgia Department of Public Health, Atlanta, and of the Fourth Service Command, Fort McPherson, Ga.

In view of the apparent association of the outbreak with a single milk supply, visits were made to all homes supplied by that dairy. At each home

an epidemiological form was completed which included the household roster, history of illness, occupation, sources of water, milk, and other foods, neighborhood contacts, contacts with cases, school and church attendance, public gatherings attended, and other similar data. Subsequently, a canvass of the town was made in which every eighth home was visited, exclusive of those served by the dairy. During this survey information was obtained from 70 families with reference to the household roster, source of milk, and history of illness. Inquiries were also made as to any recent illness in the neighborhood or any past illness suggestive of infectious hepatitis. When such illness was reported, a visit was made to the case in question.

During the current year, infectious hepatitis was known to have occurred in only one household in Forsyth prior to the outbreak in May and June. Two cases occurred in that family. The date of onset of the second case was March 7, while that of the first, although indefinite, was at least several weeks earlier. The source of the original case was not determined but it was known that prior to his illness he had visited in another town where the disease was occurring. This family appeared to have had nothing whatever in common with those involved in the subsequent outbreak, and if any contact occurred it was purely casual.

The outbreak in May and June involved 8 households, 6 of which had single cases. The dates of onset for the first and last cases were May 21 and June 28, respectively. Onsets by weekly intervals beginning with May 21 were as follows: 1, 1, 1, 4, 2, and 1.

From inquiries relating to contact between the different households, it was learned that members of 4 of them had had occasional visiting contact with each other but not with the remaining 4 families. Of the latter, members of

only 2 appeared to have had more than casual contact in the past.

As for the patients themselves, histories of exposure were obtained from some but not from others. The 2 earliest cases appeared in widely separated households which had little in common. Neither of the patients reported any previous exposure, and only the second appeared to have had contact with any of the cases which followed. The fourth and sixth cases apparently had no contact with any of the others. Each of the remaining patients gave a history of exposure to one or another of the group but, in most instances, contact was limited to convalescent cases while in some it preceded the onset of symptoms by such a few days that person to person transmission could be assumed only on the basis of an incubation period much shorter than that usually observed. In view of the experience of other contacts, however, this did not appear likely. Under similar conditions of exposure, the disease failed to spread to neighborhood contacts. Many neighborhood children had been exposed to various convalescent cases but, as of August 15, none of them had shown any symptoms of illness. Moreover, the disease did not spread readily among familial contacts. In only 2 households did second cases appear and these developed after intervals of 13 and 29 days. On the whole, the evidence relating to contact spread did not appear sufficient to explain the outbreak on that basis.

With respect to a common source of infection, evidence tending to incriminate any food or drink, except milk, was entirely lacking. Foods were obtained from several different sources and were prepared individually in each of the various homes. Only 3 of the patients had eaten meals away from home. There was no history of attendance at any common gathering where

food or drink was served. As for water, all homes in Forsyth are supplied from the same source. There was no evidence of contamination and, furthermore, the observed distribution of cases along a single milk route is not consistent with water-borne transmission. The most significant factor encountered appeared to be the common milk supply.

The people of Forsyth obtain milk from many sources. Five dairies supply the needs of approximately one-half of the population, while the remainder obtain whole milk from numerous small producers, canned milk from local stores, or none at all.

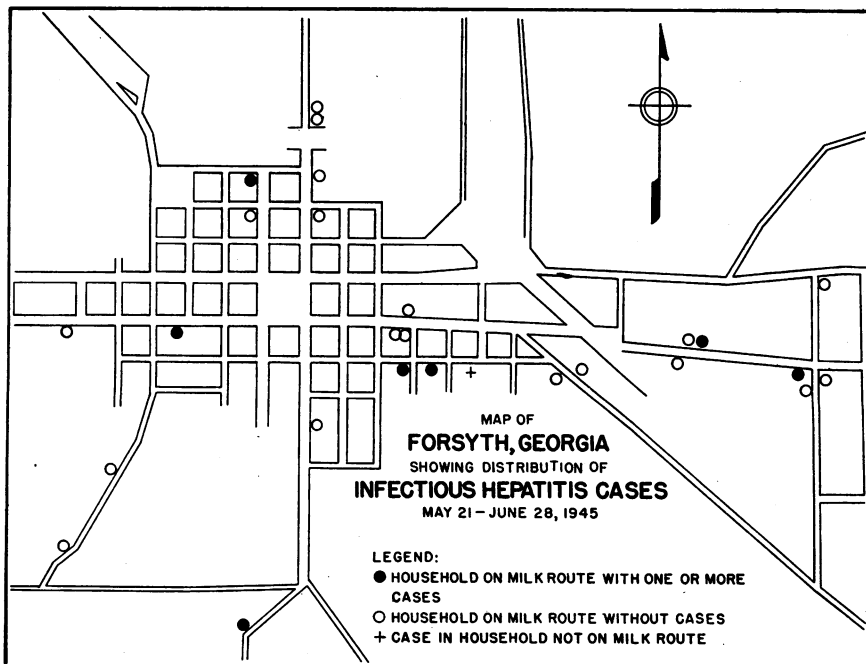
Based on the sample population obtained during the canvass, there are 586 households with 2,390 individuals in Forsyth. According to the United States Census, the population in 1940 was 2,372. The dairy under suspicion supplied raw milk to 26 households with 114 consumers, the figure in each instance being slightly less than 5 per cent of the total. The latter figure includes 4 persons who were not perma-

nent members of any of the 26 households but who ate so frequently in one or another of them that they might well be considered as regular consumers of the milk.

Of the 8 households involved in the outbreak, 7 were supplied with milk by the dairy in question. Moreover, the single case in the remaining household drank milk regularly in the home of his grandmother who was a daily customer of the dairy. One of the 10 patients actually lived in another city some 20 miles away but divided her time between her own home and that of a relative in Forsyth who was served by the dairy. From April 26 to the onset of her symptoms on June 13, she visited in Forsyth every week. During that period, no known cases occurred in the city in which she lived.

The 26 households supplied by the dairy are widely scattered throughout the town. This is shown in the accompanying map. Similarly, the households with cases are widely scattered.

As usually observed, the cases oc-



curred chiefly among those under 20 years of age. Below are shown the attack rates by age for the 114 persons who were regular consumers of the milk.

Age (Years)	Number Persons	Number Cases	Rate per 1,000
Under 20	38	9	236.8
20 and over	76	1	13.1
Totals	114	10	87.8

Of the 10 cases with frank jaundice, 2 occurred in preschool children, 5 in school children, and 3 in persons above school age. In addition to these, 4 other individuals in the group gave a history of symptoms somewhat similar to those described above but without the appearance of jaundice. They were all under 20 years of age.

In contrast to the findings in the consumer group, only one suspicious case was found among the remaining population of Forsyth. Late in June this child developed symptoms of nausea and vomiting and a slight temperature. At the same time, it was thought that she appeared more deeply tanned than usual. Recovery was complete in 3 days. The child was not seen by a physician and the symptoms were too indefinite to establish a diagnosis. Three weeks prior to the onset, the mother of the child visited one of the frank cases of hepatitis. Other than that, there was no history of contact with any known case.

The apparent absence of infectious hepatitis among those who did not drink the milk is quite striking. There are approximately 900 persons below the age of 20 years in the non-consumer group. Had these experienced the same attack rate as those who drank the milk they would have contributed 213 cases.

The 10 frank cases in the outbreak developed over a period of more than a month. This implies either a great variation in the incubation period of the disease or the infection of different patients at different times. The latter

possibility would have required contamination of the milk on more than one occasion. In view of the methods employed at the dairy, that possibility did not appear unlikely.

The dairy is located 3 miles from Forsyth and consists merely of an ordinary barn, completely devoid of all sanitary conveniences for handling milk. Approximately 100 feet from the barn is the home of the dairyman. A second house nearby is occupied by a family of relatives who moved from a neighboring state during the month of March.

No recent illness had occurred in the dairyman's family except for a mild "gastric upset" in one of 3 children which lasted for only a day or two. In the neighboring family, however, 2 cases of infectious hepatitis occurred during April and May. The symptoms in both patients were very similar to those described above. It was not possible to obtain exact dates of onset, but apparently the first case developed prior to April 15 and the second one toward the latter part of May. During this same period a third member of the family developed suspicious symptoms, but the history was too indefinite to establish a diagnosis. The source of the original case was not determined but her symptoms began within a week or two following her arrival in Georgia. There was no history of contact between these cases and those which subsequently developed in Forsyth.

This family lived in intimate contact with that of the dairyman, but apparently did not assist in caring for the milk or the utensils. Due to the primitive conditions under which the milk was prepared for delivery, however, it is possible that contamination may have occurred in other ways.

The cows were milked in a yard adjacent to the barn. The milk was then carried to a table located in the open near the barn and was simply poured

into the bottles. Everything was done by hand without any apparent attempt to prevent contamination.

Water for washing the utensils was obtained from an open, chain and bucket, dug well located about 20 feet from the table on which the milk was handled. Contamination of the well could have occurred from surface drainage or from the hands of anyone who raised a bucket of water. Experience with wells of this type has shown that in practically all instances the water shows evidence of contamination and, therefore, no samples were collected for bacteriological examination.

Located less than 100 feet from the well was a dilapidated surface toilet which was used by both families. Drainage from that point did not appear to be in the direction of the well. Apparently, however, it was not a rare practice for urine and feces to be deposited elsewhere on the surface of the ground.

Flies were numerous and were much in evidence during milking hours. They had easy access to the toilet as well as to the milk bottles and all other utensils. This combination of circumstances—numerous flies, insanitary surroundings, and unprotected food—has previously been noted in connection with an outbreak of infectious hepatitis.¹²

It is apparent that conditions at the dairy were such as to make it possible for the infective agent to gain entrance to the milk supply. It may have been carried by flies or it may have reached the milk through the water supply. Moreover, in view of the intimate contact between the two families, other possibilities cannot be excluded. In any event, contamination might well have occurred on more than one occasion.

SUMMARY

The evidence gathered during the course of this investigation, while purely circumstantial in character, points quite

definitely toward a single milk supply as the source of the outbreak. The sequence of events and the distribution of cases follow the general pattern observed in milk-borne outbreaks of other diseases. It was established that, prior to the outbreak, at least 2 cases of infectious hepatitis lived in close proximity to the source of the milk supply. Conditions at the dairy were such that contamination of the milk was possible. Subsequently, within the limits of the incubation period, cases appeared among consumers of the milk but not among non-consumers who were 20 times more numerous. Considering the conditions at the dairy, together with the observed distribution of cases, the possibility of the outbreak being unrelated to the milk supply appears to be remote.

REFERENCES

1. Pickles, W. N. Epidemic Catarrhal Jaundice. An Outbreak in Yorkshire. *Brit. M. J.*, 1:944, 1930.
2. Pickles, W. N. *Epidemiology in Country Practice*. 1939, p. 59.
3. Molner, Joseph G., and Meyer, K. F. Jaundice in Detroit. *A.J.P.H.*, 30:509, 1940.
4. Cameron, J. D. S. Infective Hepatitis. *Quart. J. Med.*, 12:139, 1943.
5. MacCallum, F. D., and Bradley, W. H. Transmission of Infective Hepatitis to Human Volunteers. *Lancet*, 2:228, 1944.
6. Findlay, G. M., and Wilcox, R. R. Transmission of Infective Hepatitis by Feces and Urine. *Lancet*, 1:212, 1945.
7. Havens, W. P., Paul, John R., and van Rooyen, C. E., and others. Human Transmission of Infective Hepatitis by the Oral Route. *Lancet*, 1:202, 1945.
8. Paul, John R., Haven, W. P., Jr., Sabin, A. B., and Philip, C. B. Transmission Experiments in Serum Jaundice and Infectious Hepatitis. *J.A.M.A.*, 128:911, 1945.
9. Voegt, H. Zur Aetiologie der Hepatitis epidemica, München. *Med. Wchnschr.*, 89:76, 1942; abstr. *Bull. Hyg.*, 17:331, 1942.
10. Neefe, John R., and Stokes, Joseph, Jr. An Epidemic of Infectious Hepatitis Apparently Due to a Water Borne Agent. *J.A.M.A.*, 128:1063, 1945.
11. Fraser, R. A Study of Epidemic Catarrhal Jaundice. *Canad. Pub. Health J.*, 22:396, 1931.
12. Kirk, Raymond. Spread of Infectious Hepatitis. *Lancet*, 1:80, 1945.

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